EDICT OF GOVERNMENT

JIS G 3302 (1998) (Japanese): Hot-dip zinc-coated steel sheet and strip

Hot-dip zinc-coated steel sheets and coils

Introduction In order to promote the diffusion of ISO Standards, it is important to broadly provide the users of steel products with information about the contents of ISO Standards. From such a perspective, the first edition of ISO 3575, *Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock-forming and drawing qualities*, published in 1976, and the third edition of ISO 4998, *Continuous hot-dip zinc-coated carbon steel sheet of structural quality*, published in 1996, have been adopted in Annex to this Standard without any modification in their technical contents, which constitute provisions of this Standard.

1 Scope This Japanese Industrial Standard specifies the steel sheets and coils (hereafter referred to as "sheet and coil"), equally zinc-coated on both surfaces by dipping in a bath of molten zinc containing not less than 97 % of zinc in percentage by mass (provided that the aluminium content is normally 0.30 % or less). In this case, the term "sheet" includes not only sheets in flat form but also corrugated sheets of the shapes and dimensions specified in **JIS G 3316**.

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS G 0303 *General rules for inspection of steel*

JIS G 3316 *Shapes and dimensions of corrugated steel sheets*

JIS H 0401 *Methods of test for hot dip galvanized coatings*

JIS Z 2201 *Test pieces for tensile test for metallic materials*

JIS Z 2241 *Method of tensile test for metallic materials*

JIS Z 8401 *Rules for rounding off of numerical values*

3 Grade and symbol Sheet and coil shall be classified into 6 grades using hot-rolled sheet coils as the base metal (hereafter referred to as "hot-rolled base metal") and into 10 grades using cold-reduced sheet coils as the base metal (hereafter referred to as "cold-reduced base metal"), and their symbols shall be as given in Tables 1 and 2.

Table 1 Grade and symbol (for hot-rolled base metal used)

Unit: mm

Classified symbol	Nominal thickness	Application
SGHC	1.6 and over, up to and incl. 6.0	Commercial quality
SGH340		Structural quality
SGH400		
SGH440		
SGH490		
SGH540		

Table 2 **Grade and symbol** (for cold-reduced base metal used)

Unit : mm

Classified symbol	Nominal thickness	Application
SGCC	0.25 and over, up to and incl. 3.2	Commercial quality
SGCH	0.11 and over, up to and incl. 1.0	Commercial quality, hard class
SGCD1	0.40 and over, up to and incl. 2.3	Drawing quality, class 1
SGCD2		Drawing quality, class 2
SGCD3	0.60 and over, up to and incl. 2.3	Drawing quality, class 3
SGC340	0.25 and over, up to and incl. 3.2	Structural quality
SGC400		
SGC440		
SGC490		
SGC570	0.25 and over, up to and incl. 2.0	

Remarks 1 When nonaging property is to be guaranteed for the sheet and coil of SGCD3 upon request by the purchaser, the symbol N shall be suffixed to their symbols, thus appearing SGCD3N. Nonaging property is referred to as the property free from stretcher strain during fabrication.

2 Nominal thicknesses other than those listed in Table 2 may be agreed upon between the purchaser and manufacturer.

3 Sheet and coil for roofing and architectural siding shall be accompanied by the symbol R for roofing and the symbol A for architectural siding after the classified symbol given in Table 2. In this case, the nominal thickness and the mass of coating shall be as specified in Annex 1.

4 For the sheet and coil subjected to corrugating in accordance with **JIS G 3316**, the symbol W and the shape symbol for corrugated sheets shall be suffixed to the classified symbol given in Table 2. In this case, the nominal thickness and the mass of coating shall be as specified in Annex 2.

5 For corrugation, the commercial, commercial hard class and structural qualities among those listed in Table 2 shall be used.

4 Type of coating The coating shall be classified into two types ; non-alloyed and iron-zinc alloyed coatings equally coated on both surfaces.

Remarks The iron-zinc alloyed coating is to produce an alloyed layer of iron and zinc which consists of predominantly δ_1 phase (with iron content ranging from 7 % to 16 %) throughout the whole coating.

5 Coating surface finishes

5.1 Types and symbols of coating surface finish for non-alloyed coating The types and symbols of coating surface finish shall be as specified in Table 3.

Table 3 Type of coating surface finish and symbol

Type of coating surface finish	Symbol	Remarks
Normal spangle	R	A coating having spangles as a result of the unrestricted growth of zinc crystals during normal solidification
Minimized spangle	Z	A coating having the spangles obtained by restricting normal spangle formation to a minimum.

5.2 Skin-pass Skin-passing to obtain surface smoothness shall be specified by the purchaser. In this case, the symbol shall be S.

6 Coating mass Coating mass shall be tested in accordance with **16.1**, and minimum coating mass on both surfaces (total mass on both surfaces) for equally coated sheet and coil and the symbol thereof shall be as follows :

a) Coating mass for equally coated sheet and coil shall be expressed as the coating mass on both surfaces of the sheet and coil. Minimum coating mass and its symbol shall be as shown in Table 4.

Table 4 Minimum coating mass for equally coated sheet and coil
(total mass on both surfaces)

Unit: g/m²

Type of coating	Coating mass symbol	Average coating mass in triple-spot test	Minimum coating mass at a single spot
Non-alloyed	(Z06) (¹)	(60) (¹)	(51) (¹)
	Z08	80	68
	Z10	100	85
	Z12	120	102
	Z18	180	153
	Z20	200	170
	Z22	220	187
	Z25	250	213
	Z27	275	234
	Z35	350	298
	Z45	450	383
	Z60	600	510
Alloyed	(F04) (¹)	(40) (¹)	(34) (¹)
	F06	60	51
	F08	80	68
	F10	100	85
	F12	120	102
	(F18) (¹)	(180) (¹)	(153) (¹)

Note (1) Symbols and values in parentheses may be applied upon agreement between the purchaser and manufacturer.

Remarks 1 Coating mass symbols Z35, Z45, Z60, F10, F12 and F18 shall not be applicable to drawing quality, classes 1, 2 and 3.

2 The average coating mass in the triple-spot test (total mass on both surfaces) shall be the average of the measured coating masses of three test pieces cut from the test specimen.

3 The minimum coating mass at a single spot (total mass on both surfaces) shall be the smallest of the measured coating masses of the three test pieces cut from the test specimen.

4 The maximum coating mass (total mass on both surfaces) may be agreed upon between the purchaser and manufacturer.

b) Minimum coating mass at a single spot on either side of equally coated sheet and coil shall be about 40 % or more of the minimum coating mass at a single spot on both surfaces (total mass on both surfacs).

7 Chemical treatment Symbols for chemical treatment for flat sheet and coil shall be as given in Table 5. Unless otherwise specified, the non-alloyed coating shall be subjected to chromate treatment and the alloyed coating shall be untreated.

Table 5 Type of chemical treatment and symbol

Type of chemical treatment	Symbol
Chromate treatment	C
Phosphate treatment	P
Untreated	M

Remarks Chemical treatments other than those listed in Table 5 may be agreed upon between the purchaser and manufacturer.

8 Oiling Symbols for oiling for flat sheet and coil shall be as given in Table 6. Unless otherwise specified, the non-alloyed coating shall be unoiled and the alloyed coating shall be oiled.

Table 6 Discrimination of oiling and symbol

Discrimination of oiling	Symbol
Oiled	O
unoiled	X

9 Mechanical properties

9.1 Test items Test items for flat sheet and coil shall be as given in Table 7.

Table 7 Test items

Classified symbol	Bend test	Tensile test
SGHC	○	–
SGH340	○	○
SGH400	○	○
SGH440	○	○
SGH490	○	○
SGH540	○	○
SGCC	○(2)	–
SGCH	–	–
SGCD1	○	○
SGCD2	○	○
SGCD3	○	○
SGC340	○	○
SGC400	○	○
SGC440	○	○
SGC490	○	○
SGC570	–	○

Note (2) This shall not be applied when sheet and coil are used for corrugation.

Remarks Test items for roofing and architectural siding shall be those which correspond to the specified symbol among those given in Table 7.

9.2 Bendability As to bendability for the flat sheet and coil specified in **9.1**, when the sheet and coil are tested in accordance with **16.2** and Table 8, there shall not be any flaking of the coating, cracking (visible to the naked eye) or fracture of the base metal on the outside of the bent portion (within an area not less than 7 mm from each side of the test piece).

9.3 Yield point, tensile strength, elongation and nonaging property Tests for the yield point, tensile strength, elongation and nonaging property (only for cold-reduced base metal used) of the sheet and coil specified in **9.1** shall be made in accordance with **16.3**, and the test results shall comply with Tables 9 or 10.

The yield point shall be the upper yield point.

Table 9 Yield point, tensile strength and elongation
(for hot-rolled base metal used)

Classified symbol	Yield point N/mm^2	Tensile strength N/mm^2	Elongation %	Test piece and direction of tensile test
SGHC	–	–	–	No. 5, in rolling direction
SGH340	245 min.	340 min.	20 min.	
SGH400	295 min.	400 min.	18 min.	
SGH440	335 min.	440 min.		
SGH490	365 min.	490 min.	16 min.	
SGH540	400 min.	540 min.		

Informative reference : For SGHC, the yield point and tensile strength are normally at least 205 N/mm^2 and 270 N/mm^2, respectively.

Table 10 Yield point, tensile strength, elongation and nonaging property
(for cold-reduced base metal used)

Classified symbol	Yield point N/mm^2	Tensile strength N/mm^2	Elongation %						Test piece and direction of tensile test
			Nominal thickness mm						
			0.25 and over, up to 0.40	0.40 and over, up to 0.60	0.60 and over, up to 1.0	1.0 and over, up to 1.6	1.6 and over, up to 2.5	2.5 and over	
SGCC	–	–	–	–	–	–	–	–	No. 5, in rolling direction
SGCH	–	–	–	–	–	–	–	–	
SGCD1	–	270 min.	–	34 min.	36 min.	37 min.	38 min.	–	
SGCD2	–	270 min.	–	36 min.	38 min.	39 min.	40 min.	–	
SGCD3	–	270 min.	–	38 min.	40 min.	41 min.	42 min.	–	
SGC340	245 min.	340 min.	20 min.	20 min.	20 min.	20 min.	20 min.	20 min.	
SGC400	295 min.	400 min.	18 min.	18 min.	18 min.	18 min.	18 min.	18 min.	
SGC440	335 min.	440 min.	18 min.	18 min.	18 min.	18 min.	18 min.	18 min.	
SGC490	365 min.	490 min.	16 min.	16 min.	16 min.	16 min.	16 min.	16 min.	
SGC570	560 min.	570 min.	–	–	–	–	–	–	

Table 8 Bendability

Classified symbol		Bend angle 180°								
		Up to 1.6 mm in nominal thickness			1.6 mm and over, up to 3.0 mm in nominal thickness			3.0 mm and over in nominal thickness		
		Coating mass symbol			Coating mass symbol			Coating mass symbol		
Hot-rolled base metal	Cold-reduced base metal	Z27 or lighter	Z35	Z45, Z60	Z27 or lighter	Z35	Z45, Z60	Z27 or lighter	Z35	Z45, Z60
SGHC	SGCC	1	1	2	1	2	2	2	2	2
–	SGCH	–	–	–	–	–	–	–	–	–
–	SGCD1	1	–	–	1	–	–	–	–	–
–	SGCD2 SGCD3	0	–	–	0	–	–	–	–	–
SGH340	SGC340	1	1	2	1	1	2	2	2	3
SGH400	SGC400	2	2	2	2	2	2	3	3	3
SGH440 SGH490 SGH540	SGC440 SGC490	3	3	3	3	3	3	3	3	3
–	SGC570	–	–	–	–	–	–	–	–	–

Remarks 1 When hot-rolled base metal is used, the above shall apply to the nominal thicknesses of 1.6 mm and over.

2 The values in Table 8 represent the internal spacing of the bend, expressed as the number of sheets of the nominal thickness.

Remarks 1 When nonaging property is specified for the sheet and coil of SGCD3, this property shall be guaranteed for the period of six months after shipment from the manufacturer's factory.

2 For nominal thicknesses less than 0.25 mm, tensile test may be omitted.

Informative reference : For SGCC, the yield point and tensile strength are normally at least 205 N/mm^2 and 270 N/mm^2, respectively.

SGCH is a material not subjected to annealing, usually having a Rockwell hardness (HRB) of 85 or more or a Vickers hardness (HV) of 170 or more (the test load may be chosen appropriately).

10 Presentation of dimensions The dimensions of sheet and coil shall be expressed as follows:

a) The dimensions of sheet shall be expressed in thickness, width and length in millimeters, respectively.

b) The dimensions of coil shall be expressed in thickness and width in millimeters, respectively. When the mass of coil is expressed as theoretical mass, however, the length shall be given in meters.

c) The thickness of sheet and coil shall be expressed in the thickness of the base metal prior to coating in millimeters, and this shall be regarded as the nominal thickness.

11 Standard dimensions The standard dimensions of sheet and coil shall be as specified below. However, the standard nominal thickness of corrugated sheet and the standard width and length prior to corrugation shall comply with Annex 2. Further, the standard length and width of corrugated sheet after corrugation shall comply with **JIS G 3316**.

a) **standard nominal thickness** The standard nominal thickness of sheet and coil shall be as given in Table 11.

Table 11 Standard nominal thickness

Unit: mm

(0.27)	(030)	(0.35)	0.40	0.50	0.60	0.70	0.80	0.90	1.0	1.2	1.4	1.6
1.8	2.0	2.3	2.8	3.2	3.6	4.0	4.5	5.0	5.6	6.0		

Remarks 1 The values in parentheses shall ba applied to coating mass symbol Z18 or heavier coatings.

2 Upon agreement between the purchaser and manufacturer, the thicknesses of 0.65 mm and 0.75 mm may serve as standard nominal thicknesses.

b) **standard width and standard length of sheet** The standard width of sheet and coil and the standard length of sheet shall be as given in Table 12.

Table 12 Standard width and length

Unit: mm

Standard width	Standard length of sheet
762	1 829 2 134 2 438 2 743 3 048 3 353 3 658
914	1 829 2 134 2 438 2 743 3 048 3 353 3 658
1 000	2 000
1 219	2 438 3 048 3 658
1 524	3 048
1 829	3 658

Remarks As for coil, 610 mm shall also be regarded as the standard width, in addition to those given in the above table.

12 Dimensional tolerances

12.1 Thickness tolerances Tolerances for the thickness of sheet and coil shall be as follows:

a) Thickness tolerances shall apply to nominal thickness plus the equivalent thickness of coating given in Table 16.

b) Thickness tolerances shall be as given in Tables 13, 14 or 15.

Thickness shall be measured at any point not less than 25 mm from a side edge.

Table 13 Thickness tolerances
(for hot-rolled base metal used for commercial quality)

Unit: mm

Nominal thickness	Width			
	Up to 1 200	1 200 and over, up to 1 500	1 500 and over, up to 1 800	1 800 and over, up to and incl. 2 300
1.60 and over, up to 2.00	±0.17	±0.18	±0.19	±0.22 ([3])
2.00 and over, up to 2.50	±0.18	±0.20	±0.22	±0.26 ([3])
2.50and over, up to 3.15	±0.20	±0.22	±0.25	±0.27
3.15 and over, up to 4.00	±0.22	±0.24	±0.27	±0.28
4.00 and over, up to 5.00	±0.25	±0.27	–	–
5.00 and over, up to 6.00	±0.27	±0.29	–	–
6.00	±0.30	±0.31	–	–

Note ([3]) These figures shall apply to widths under 2 000 mm.